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(54) Weighing and packing system

(57) Provided is a weighing and packing system having excellent quick response to control information and capable of easily adding and changing hardware. A weighing driving section 12 is provided on each weighing unit 11 forming a combination scale of a weighing system 121. The weighing driving section 12 is formed by a CPU board 13, motor drivers 14 and 15 for driving stepping motors 18 and 19, a load cell 20, an A / D converter 16, and a feeder driver 17 for driving a feeder 21. The CPU board 13 is connected to a LAN cable 23 through a LAN interface 22. An interface board 89 having a first interface 85 is connected to the LAN cable 23, which are connected to a second interface 84 provided on a packing control section 82 on a packing system 122 side through four parallel signal lines. In addition, a weighing control unit 26 for giving control information is provided on the weighing driving section 12 of the weighing unit 11. The weighing control unit 26 is connected to the LAN cable 23 and is connected to the packing control section 82 through a serial line 32b.

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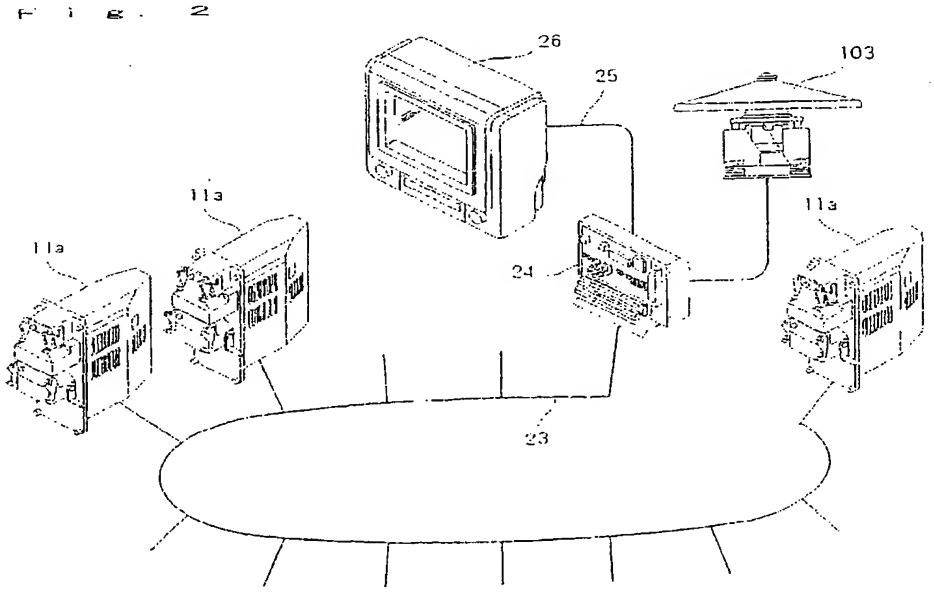

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Description

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to a weighing system, a packing system and a weighing and packing system, and more particularly to a weighing system, a packing system and a weighing and packing system in which a weighing driving section of each of a plurality of weighing units, a weighing control section for controlling the weighing driving section, a packing driving section of a packer, a packing control section for controlling the packing driving section and the like are coupled through a LAN.

Description of the Related Art

Conventionally, a combination scale has been combined with a packer to form a weighing and packing system to be used. Fig. 13 shows a weighing and packing system according to the prior art. The weighing and packing system comprises a scale driving section 182 for driving a combination scale body 183, and a weighing control section 181 for controlling the scale driving section 182. The weighing control section 181 is connected to a SIO (serial interface) 199a of a control indicating section 198 through a SIO 190a. Weighing data and the like sent from the combination scale body 183 is converted to digital information by an A / D converter 184, and the digital information is transmitted to the control indicating section 198 through the SIO 190a.

The weighing and packing system comprises a packing driving section 187 for driving a packer body 188, and a packing control section 186 for controlling the packing driving section 187. The packing control section 186 is connected to a SIO 199b ofthe control indicating section 198 through a SIO 190b. Temperature information and the like sent from the packer body 188 is converted to digital information by an A / D converter 189, and the digital information is transmitted to the control indicating section 198 through the SIO 190b.

The control indicating section 198 includes a microcomputer 197, an operation input section 191, a display section 192, and the SIOs 199a and 199b. Furthermore, the microcomputer 197 has a key input register 193, an operating condition table 194, an operation state register 195, a display buffer 196 and the like.

In the weighing and packing system, control information is sent from the microcomputer 197 to the weighing control section 181 in response to input from the operation input section 191. The weighing control section 181 controls the scale driving section 182 on the basis of the control information so that the combination scale body 183 is caused to operate. Data such as a weighed value sent from the combination scale body 183 is converted to a digital value by the A / D converter 184, and the digital value is sent to the control indicating section 198 and is displayed by the display section 192. In a packer control section 190, the packing driving section 187 is controlled according to an instruction sent from the control indicating section 198 so as to pack an article to be weighed which is fed from the combination scale body 183. Data obtained from the packer, for example, a seal temperature or the like is converted to a digital value by the A ./ D converter 189, and the digital value is sent to the control indicating section 198 and is displayed by the display section 192. In the weighing and packing system, thus, combination weighing and packing operation is performed under unified control of the control indicating section 198.

In the system shown in Fig. 13, however, data are transferred through the SIOs 190a, 190b, 199a and 199b, and a transmission line formed by a serial line. For this reason, there is a problem that the system has poor quick response to the control information and the like sent from the combination scale body 183 to the packer body 188 after completion of weighing operation. In addition, if abnormalities are caused on the combination scale body 183 or the packer body 188, it is impossible to rapidly halt weighing and packing operation. Furthermore, if abnormalities are caused on transmission lines connecting the SIOs 190a and 199a and the SIOs 190b and 199b, the weighing and packing operation should be halted.

In the system shown in Fig. 13, if the weighing units forming the combination scale are to be exchanged or added, the operation should be stopped. Therefore, an operational efficiency of the system is lowered. Also in the packer body, if a section forming the packer body, for example, a sensor for a seal temperature is to be added, hardware of the packer control section 190 should be changed correspondingly.

SUMMARY OF THE INVENTION

In order to solve the above-mentioned problems of the prior art, it is an object of the present invention to provide a weighing and packing system in which quick response to control information is excellent, it is not necessary to halt weighing and packing operation even if abnormalities are caused on a transmission line, and sections forming a combination scale and a packer body can easily be added and changed if necessary.

In the weighing and packing system according to the present invention, a LAN is provided so that control information and data can be transferred at a high speed and hardware can rapidly be added and changed.

According to another embodiment of the weighing and packing system of the present invention, a parallel signal line and signal transmitting means are provided between a weighing system and a packing system so that control information and data can be transferred at a high speed.

According to the embodiment of the present inven-

tion, a serial signal line is provided between a weighing system and a packing system in place of a parallel signal line. Consequently, even if abnormalities such as disconnection of a LAN are caused, weighing and packing operation can be continued.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a block diagram showing a schematic structure of a weighing and packing system according to an embodiment of the present invention;
Figure 2 is a view conceptually showing a weighing system in Figure 1;
Figure 3 is a perspective view showing a structure of a weighing unit in Figure 1;
Figure 4 is a block diagram showing a structure of a feed - discharge control section in Figure 1;
Figure 5 is a perspective view showing an external structure of the weighing system in Figure 1;
Figure 6 is a diagram showing an example of control information to be used for the weighing system in Figure 1;
Figure 7 is a perspective view showing an appearance of a packer forming a packing system in Figure 1;
Figure 8 is a block diagram showing a schematic structure of a weighing and packing system according to another embodiment of the present invention;
Figure 9 is a block diagram showing a schematic structure of a packing system in Figure 8;
Figure 10 is a block diagram showing a schematic structure of a weighing and packing system according to yet another embodiment of the present invention;
Figure 11 is a block diagram showing a schematic structure of a weighing and packing system having a serial signal line according to an embodiment of the present invention;
Figure 12 is a block diagram showing a schematic structure of a weighing and packing system having a serial signal line according to another embodiment of the present invention; and
Figure 13 is a block diagram showing a weighing and packing system according to the prior art.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The weighing and packing system according to the present invention comprises a weighing system and a packing system. In an embodiment of the weighing system, a combination scale is formed by a plurality of weighing units. In the weighing system, a weighing driving section for causing the weighing unit to perform weighing operation, a weighing control section for controlling the weighing driving section, and an operation indicating section for setting operating conditions of the weighing system and for displaying an operation state are mutually connected through a LAN. A first parallel interface is connected to the LAN. The packing system according to the present invention includes a packer which has a packing driving section for causing packing operation to be performed and serves to pack an article to be weighed, a packing control section for controlling the packing driving section, and a second parallel interface. The first and second parallel interfaces are connected to each other through a parallel signal line. An interlock signal is sent and received between the packing driving sections through the parallel signal line. The weighing and packing system according to the present invention comprises signal transmitting means for connecting the operation indicating section of the weighing control unit of the weighing system to the packing control section. The signal transmitting means sets operating conditions of the weighing system and the packing system, and displays operation states.

According to the above-mentioned structure, since the weighing and packing system according to the present invention comprises first and second parallel interfaces and a parallel signal line, quick response to control information is excellent. Furthermore, the weighing system employs a structure of the LAN. Therefore, hardware can rapidly be added and changed in the weighing system. In addition, the operation indicating section can set operating conditions of the weighing system and the packing system and can display operation states. Therefore, single management of the weighing system and the packing system can be performed. Furthermore, even if abnormalities are caused on the LAN in the weighing system, control information is sent and received through the parallel signal line. Therefore, the weighing and packing operation is not stopped.

In the weighing and packing system according to another embodiment of the present invention, a first parallel interface is provided on a weighing system side, and inside portions of the packing system are connected through a LAN to which a second parallel interface is connected. A parallel signal line is provided between the first and second parallel interfaces. An interlock signal is sent and received between packing driving sections through the parallel signal line. Furthermore, the weighing and packing system according to the present invention comprises signal transmitting means for connecting an operation indicating section of a packing control unit of the packing system and a weighing control section. The signal transmitting means sets operating conditions of the weighing system and the packing system, and displays operation states.

According to the above-mentioned structure, since the weighing and packing system according to the present invention comprises a parallel signal line, quick response to control information is excellent. Furthermore, the packing system employs the LAN. Therefore, hardware can rapidly be added and changed in the packing system. In addition, the operation indicating section can set operating conditions of the weighing sys-

tem and the packing system, and can display operation states. Therefore, single management of the weighing system and the packing system can be performed. Furthermore, even if abnormalities are caused on the LAN of the packing system, control information is sent and received through the parallel signal line. Therefore, the weighing and packing operation is not stopped.

A weighing and packing system according to yet another embodiment of the present invention comprises a weighing system and a packing system which have LANs, respectively. The respective LANs are further connected to form a single LAN. This system also has excellent quick response to control information and flexibility with addition and change of hardware as described above. In addition, weighing and packing operation can be continued even if abnormalities are caused on the LAN.

A weighing and packing system according to a further embodiment of the present invention has a structure in which the weighing driving section, the packing driving section and a weighing and packing control unit including the weighing control section, the packing control section and the operation indicating section are mutually connected through a single LAN. This system also has excellent quick response to control information and flexibility with addition and change of hardware, and can continue weighing and packing operation even if abnormalities are caused on the LAN. In addition, the operation indicating section can set operating conditions of a weighing system and a packing system, and can display operation states. Therefore, single management of the weighing system and the packing system can be performed.

In addition, the weighing and packing system according to the present invention can have a structure in which first and second serial interfaces and a serial signal line are provided in place of the first and second parallel interfaces and the parallel signal line. By this structure, if abnormalities are caused on the LAN, an interlock signal can be sent and received through the serial signal line. Therefore, it is not necessary to stop the weighing and packing operation. Also in the case where the interlock signal is transmitted late through the LAN and the like for some reasons, it can be sent and received through the serial signal line. If abnormalities are caused on the signal transmitting means between the operation indicating section and the packing control section or the weighing control section, the signal can be received around the serial signal line.

Preferred embodiments of the present invention will be described below with reference to the drawings.

Fig. 1 is a block diagram showing a schematic structure of a weighing and packing system 120 according to an embodiment of the present invention. The weighing and packing system 120 according to the present embodiment comprises a weighing system 121 and a packing system 122. The weighing system 121 has a structure of a LAN which is conceptually shown in Fig. 2. Fig. 3 is a perspective view showing an external structure of a weighing unit 11 which will be described below. As shown in Fig. 1, the weighing system 121 of the weighing and packing system 120 according to the present embodiment has a structure in which a combination scale (not shown) is formed by a plurality of weighing units 11, each of which has a weighing driving section 12 for causing weighing operation to be performed. The weighing driving section 12 includes a CPU board 13, motor drivers 14 and 15 for driving stepping motors 18 and 19 respectively, an A / D converter 16 for A / D converting a weighed value of an article to be weighed which is sent from a load cell 20, and a feeder driver 17 for driving a feeder 21. In the present embodiment, the weighing unit 11 does not include the feeder 21 but the feeder driver 17. The CPU board 13 is connected to a LAN cable 23 through a LAN interface 22. While the feeder driver 17 is included in the weighing unit 11 in the present embodiment, it may be attached to the feeder 21 to which only a control signal is sent from the weighing unit 11.

As shown in Fig. 3, the weighing unit 11 has a weighing unit body 11a. The feeder 21 which is driven by the feeder driver 17 (Fig. 1) is attached to a top of the weighing unit body 11a. The stepping motor 18 (Fig. 1) of the weighing unit body 11a is provided with a switching device 18a for opening or closing a gate of a feed hopper 28. The feed hopper 28 is removably attached to the switching device 18a. The stepping motor 18 functions as switching means for the feed hopper 28. Similarly, the stepping motor 19 (Fig. 1) is provided with a switching device 19a for opening or closing a gate of a weighing hopper 29. The weighing hopper 29 is removably attached to the switching device 19a. The stepping motor 19 functions as switching means for the weighing hopper 29. In addition to the stepping motor, a solenoid, an air cylinder, a servo motor and the like can be used as the switching means for the hoppers 28 and 29. The motor drivers 14 and 15, the A / D converter 16 and the feeder driver 17 are controlled by the CPU board 13. For simplicity, only the weighing unit body 11a is shown in Fig. 2. While only the feed hopper 28 and the weighing hopper 29 are provided as described above, a memory hopper for holding a weighed article can further be provided, for example.

As shown in Fig. 1, the weighing system 121 according to the present embodiment comprises a feed - discharge control section 27 for controlling feed and discharge of an article to be weighed. Fig. 4 shows a block structure of the feed - discharge control section 27. As shown in Fig. 4, the feed - discharge control section 27 includes a center vibrator unit 101 and a collection gate unit 102.

The center vibrator unit 101 has a center vibrator 103 for feeding the article to be weighed to the feeder 21 of the weighing unit 11 by vibration, and a feeder driver 104 for driving the center vibrator 103. The feeder driver 104 regulates a quantity of the article fed from the

center vibrator 103 to the feeder 21 (Fig. 3) under control of a CPU board 109. The center vibrator unit 101 has an A / D converter 106 for A / D converting a weighed value in a level sensor load cell 105 for weighing the article on the center vibrator 103. A digital value obtained by conversion is sent to the CPU board 109. The CPU board 109 is connected to the LAN cable 23 through a LAN interface 110. In the present embodiment, the center vibrator unit 101 is formed by the center vibrator 103, the feeder driver 104, the A / D converter 106, the CPU board 109 and the LAN interface 110. The CPU board 109 and the LAN interface 110 are shared with the assembled gate unit 102, which will be described below.

An optical sensor for product level detection and an optical sensor controller can be used in place of the level sensor load cell 105 and the A / D converter 106. The level sensor load cell 105 and the optical sensor for product level detection function as means for detecting an article to be weighed. The A/D converter 106 and the optical sensor controller function as digital converting means.

The collecting gate unit 102 has a collecting gate (not shown) provided in a lower portion of a chute 31 shown in Fig. 5 which will be described below. The collecting gate is opened or closed by a collecting gate motor 107 which acts as the gate switching means, and serves to store the article discharged from the weighing unit 11 and to discharge the same article to a packer in a predetermined timing. The collecting gate motor 107 is driven by a motor driver 108 under control of the CPU board 109. In the present embodiment, the collecting gate unit 102 is formed by the collecting gate motor 107, the motor driver 108, the CPU board 109 and the LAN interface 110. The CPU board 109 and the LAN interface 110 are shared with the center vibrator unit 101 as described above.

Furthermore, the weighing system 121 according to the present embodiment is provided with a weighing control unit 26 connected to the LAN cable 23 through an optical fiber 25 and a photoelectric converter 24 as shown in Fig. 1. The weighing control unit 26 includes a weighing control section 26a, an operation indicating section 26b and a display section 26c formed of a LCD or the like. The operation indicating section 26b causes the display section 26c to display a prompt screen, inputs a target weight of the article to be weighed, upper and lower bound values thereof, switching times of the hoppers 28 and 29, delay times of various operation, and operating conditions of the feeder 21 and the like, and sets the same conditions to the CPU board 13 of the weighing unit and the weighing control section 26a. The operation indicating section 26b causes the display section 26c to properly display the weighed value of the article during operation, an average value thereof, a standard deviation, a weighing speed, hoppers used for a combination, operating conditions, operation states, the contents of an alarm and the like. In the present embodiment, the weighing control section 26a performs single management of the whole weighing system 121. The photoelectric converter 24 can be housed in an I / O box or the like together with the feed - discharge control section 27 shown in Fig. 4, for example.

Actually, the weighing system 121 according to the present embodiment has an external structure shown in Fig. 5. As shown in Fig. 5, the weighing unit 11 is fixed around a center column 30, and the center vibrator 103 is fixed in the center on a top of the center column 30. The chute 31 is provided in a lower portion of the center column 30. The collecting gate (not shown) is provided below the chute 31. The packer (not shown) is provided below the collecting gate.

Fig. 6 shows an example of control information to be used by the LAN shown in Figs. 1 and 2. In the example of Fig. 6, control information of "04H, 4 * H" ("H" represents a hexadecimal number) are sent from the weighing control section 26a of the weighing control unit 26 to the LAN. "04H" is a header code which means an instruction issued from the weighing control section 26a to the weighing unit 11 and represents that the next instruction "4 * H" should be executed by the weighing unit 11. The instruction "4 * H" is a general term for instructions "40H to 43H" as shown in Fig. 6. The weighing unit 11 executes the instructions "40H to 43H" shown in Fig. 6.

The weighing unit 11 which has executed the instructions "40H to 43H" sends, to the LAN, response information including "84H, 4 * H, an A / D value and an error code" as shown in Fig. 6. "84H" means a response issued from a specific weighing unit 11 to the weighing control section 26a. "4 * H" means a response to a result of execution of the instructions "40H to 43H". The A / D value is data on a weight of the article. The error code represents a kind of malfunction generated by the weighing unit 11.

The packing system 122 of the weighing and packing system according to the present embodiment is shown in Fig. 1 described above. The packing system 122 according to the present embodiment does not employ the structure of the LAN. Fig. 7 shows an appearance of a packer 41 forming the packing system 122. As shown in Fig. 7, the packer 41 according to the present embodiment includes a heater 43 for longitudinal seal for heat sealing a packing film 42 cylindrically, an air cylinder 44 for longitudinal seal for pressing the heater 43, a pull belt 45 for sending the cylindrical packing film 42 downward, a heater 46 for transverse seal for performing transverse seal after filling the article to be weighed which is fed from a hopper 31, air cylinders 47, 47 for transverse seal for pressing the heater 46, a cutter 48 for cutting the packing film 42 after the transverse seal, and an air cylinder 49 for a cutter for driving the cutter 48. In the present embodiment, the heaters 43 and 46 are used as heating means, and the air cylinders 44 and 47, 47 are used as seal pressing means. For example, a motor or the like can be used as the seal

pressing means.

According to the present embodiment, the air cylinder 44 for longitudinal seal, the air cylinder 47 for transverse seal, the air cylinder 49 for a cutter, and the pull belt 45 are connected to drivers 64c, 67c, 69c and 65c as shown in Fig. 1. The heater 43 for longitudinal seal and the heater 46 for transverse seal are connected to temperature controllers 79c and 80c, respectively.

The drivers 64c, 67c, 69c and 65c and the temperature controllers 79c and 80c are connected to a CPU board 83 in a packing control section 82. The CPU board 83 is connected to a second parallel interface 84 which is connected to a first parallel interface 85 of an interface board 89 of the weighing system 121 through a parallel signal line 86. In the present embodiment, a CPU board 87 and a LAN interface 88 provided on the interface board 89 may be shared with the CPU board 109 and the LAN interface 110 of the feed - discharge control section 27 shown in Fig. 4, and the first parallel interface 85 may be connected to the CPU board 109.

In the present embodiment, an optical fiber 32a, a photoelectric converter 32 and a serial line 32b are provided, which serially connect the operation indicating section 26b of the weighing control unit 26 of the weighing system 121 to the packing control section 82 of the packing system. The optical fiber 32a, the photoelectric converter 32 and the serial line 32b function as signal transmitting means. While the signal transmitting means has been formed serially as described above in the present embodiment, it can be formed by a parallel signal line.

In the present embodiment, the parallel signal line 86 is formed by four signal lines. Each signal line receives only one of four interlock signals which will be described below. More specifically, the four signal lines exclusively transmit four interlock signals, that is, "Ready Signal from Packer" which indicates that the packing system requires an article to be weighed to be put in the weighing system, "Ready Signal to Packer" which indicates that the weighing system can accept the article, "Dump Signal to Packer" which informs the packing system that the article has been put in the weighing system, and "Significant Fault Checking" by which the weighing system informs the packing system that a weight of the put article deviates from a tolerance.

The optical fiber 32a, the photoelectric converter 32 and the serial line 32b are used for the operation indicating section 26b to set operating conditions on a packing system side and to cause the display section 26c to display an operation state on the packing system side.

In the weighing and packing system 120 according to the present embodiment, a packing system 122 side is connected to a weighing system 121 side through the parallel signal line 86. Therefore, the interlock signal to be sent and received between the systems can be transmitted rapidly. The operation indicating section 26b can set the operating conditions of the weighing and packing system, and can display the operation state. Consequently, single management of the weighing and packing system can be performed.

Since the weighing system 121 of the weighing and packing system 120 according to the present embodiment sends and receives the control information, the response information and the like through the LAN cable 23 at a high speed. it has excellent quick response to the control information and each weighing unit can be removed and attached during operation.

While the CPU board 13 and the LAN interface 22 have separately been provided in the present embodiment, both functions can be fulfilled by one CPU board. Similarly, the CPU board 109 and the LAN interface 110 can be formed by one CPU board.

Fig. 8 shows another embodiment of the weighing and packing system according to the present invention. A weighing and packing system 130 according to the present embodiment comprises a packing system 132 formed by a LAN. In the packing system 132, an interface board 129 is connected to a LAN cable 63. The interface board 129 includes a LAN interface 128, a CPU board 127 and a first parallel interface 125 which are connected to the LAN cable 63 of the packing system 132 through the LAN interface 128.

A weighing system 131 of the weighing and packing system 130 according to the present embodiment includes stepping motors 18 and 19, motor drivers 14 and 15 for driving and controlling the stepping motors 18 and 19, a load cell 20, an A / D converter 16 for A / D converting a weighed value obtained from the load cell 20, and a feeder driver 17 for driving a feeder 21 in the same manner as in the weighing system shown in Fig. 1. However, the system according to the present embodiment is different from the weighing system 121 shown in Fig. 1 in that a weighing control section 26a is provided. In the present embodiment, furthermore, the weighing system 131 does not employ a structure of a LAN.

The weighing system 131 of the weighing and packing system 130 according to the present embodiment includes the weighing control section 26a on which a CPU board 123 is provided. The motor drivers 14 and 15, the A / D converter 16 and the feeder driver 17 are connected to the CPU board 123. The CPU board 123 is connected to a first parallel interface 124. The first parallel interface 124 is connected to a second parallel interface 125 of the interface board 129 of the packing system 132 through a parallel signal line 126. For simplicity, only one weighing unit is shown in Fig. 8. Actually, the motor drivers 14 and 15 and the A / D converter 16 of each of the weighing units are connected to the CPU board 123. Also in the present embodiment, the CPU board 127 and the LAN interface 128 provided on the interface board 129 can be shared with another CPU board and LAN interface.

In the present embodiment, an optical fiber 66a, a photoelectric converter 66 and a serial line 66b are provided, which serially connect an operation indicating section 62b of the packing control unit 62 of the packing

system 132 to the weighing control section 26a of the weighing system. The optical fiber 66a, the photoelectric converter 66 and the serial line 66b function as signal transmitting means. While the signal transmitting means has been formed serially as described above in the present embodiment, it can also be formed by a parallel signal line.

Fig. 9 shows a block structure of the packing system 132 of the weighing and packing system 130 according to the present embodiment. An appearance of a packer 41 forming the packing system 132 according to the present embodiment is the same as in Fig. 7. According to the present embodiment, an air cylinder 44 for longitudinal seal, an air cylinder 47 for transverse seal, an air cylinder 49 for a cutter, a pull belt 45, a heater 43 for longitudinal seal and a heater 46 for transverse seal are connected to driving control sections 64, 67, 69, 65, 79 and 80 respectively as shown in Fig. 9. The driving control sections 64, 67, 69, 65, 79 and 80 have CPU boards 64a, 67a, 69a, 65a, 79a and 80a, and LAN interfaces 64b, 67b, 69b, 65b, 79b and 80b, respectively. The LAN interfaces 64b, 67b, 69b, 65b, 79b and 80b are connected to the LAN cable 63. The driving control sections 64, 67, 69 and 65 connected to the air cylinder 44 for longitudinal seal, the air cylinder 47 for transverse seal, the air cylinder 49 for a cutter and the pull belt 45 have drivers 64c, 67c, 69c and 65c for driving the cylinders and belt, respectively. The driving control sections 79 and 80 connected to the heater 43 for longitudinal seal and the heater 46 for transverse seal have temperature controllers 79c and 80c, respectively. In the present embodiment, the driving control sections 64, 67, 69, 65, 79 and 80 form a packing driving section 81.

In the packing system 132 according to the present embodiment, the packing control unit 62 connected to the LAN cable 63 is provided through the optical fiber 61a and the photoelectric converter 61 as described above. The packing control unit 62 includes a packing control section 62a, the operation indicating section 62b, and a display section 62c formed of a LCD or the like. The operation indicating section 62b causes the display section 62c to display a prompt screen, inputs operating conditions such as a set temperature and an operation time of each seal section, an operation time of a cutter 48, delay times of various operation and the like, and sets the same conditions to the packing control section 62a and the CPU boards 64a, 67a, 69a, 65a, 79a and 80a. The operation indicating section 62b causes the display section 62c to properly display a temperature of each seal section, a packing speed, the operating conditions, the contents of an alarm and the like. In the present embodiment, the packing control section 62a performs single management of the whole packing system 132.

Since the packing system 132 according to the present embodiment sends and receives the control information, the response information and the like through the LAN cable 63 at a high speed, it is excellent in quick response to the control information. Furthermore, the system can easily be varied with a change in packing form, for example, air cylinders can easily be increased or removed and sensors can easily be added or removed. Examples of a change in the system include addition of film edge sensors 112, 112 for detecting a slippage of a packing film 42, eyemark sensors 113, 113 for detecting a mark printed on the packing film 42, a film near end sensor 114 for detecting that the packing film 42 is running short, a sensor 115 (not shown) for detecting intrusion of an article to be weighed or the like into the heaters 46, 46 for transverse seal and the like as shown in Fig. 7.

While the CPU boards 64a, 67a, 69a, 65a, 79a and 80a and the LAN interfaces 64b, 67b, 69b, 65b, 79b and 80b have been provided on the driving control sections 64, 67, 69, 65, 79 and 80 of the air cylinders 44, 47 and 49, the belt 45, and the heaters 43 and 46 respectively in the present embodiment, the CPU boards and the LAN interfaces can be collected together such that the air cylinders 44, 47 and 49, the belt 45, and the heaters 43 and 46 can be controlled in one portion.

Also in the present embodiment, the parallel signal line 126 is formed by four signal lines. In the same manner as in the embodiment of Fig. 1, each signal line receives four interlock signals. The optical fiber 66a, the photoelectric converter 66 and the serial line 66b are used for the operation indicating section 62b to set operating conditions on a weighing system side and to cause the display section 62c to display an operation state on the weighing system side.

Also in the weighing and packing system according to the present embodiment, a packing system side is connected to a weighing system side through the parallel signal line 126. Therefore, the interlock signal to be sent and received between the systems can be transmitted rapidly. The operation indicating section 62b can set the operating conditions of the weighing and packing system, and can display the operation state. Consequently, single management of the weighing and packing system can be performed.

According to the present invention, the weighing system 121 of the weighing and packing system 120 shown in Fig. 1 and the packing system 132 shown in Fig. 9 can be used to form a weighing and packing system. The weighing and packing system is formed by connecting the LAN cable 23 (Fig. 1) of the weighing system 121 to the LAN cable 63 (Fig. 9) of the packing system 132 directly or through a repeater. Such a weighing and packing system has exact characteristics of the weighing system 121 and the packing system 132, and features that control information and data can be sent and received at a high speed between the weighing system 121 and the packing system 132. In this case, it is not necessary to provide the optical fiber 32a, the photoelectric converter 32 and the serial line 32b, and the optical fiber 66a, the photoelectric converter 66 and the serial line 66b.

Fig. 10 shows a further embodiment of the weighing and packing system according to the present invention. In the weighing and packing system according to the present embodiment, portions other than the weighing control unit 26, the optical fiber 25 and the photoelectric converter 24 of the weighing system 121 shown in Fig. 1 are connected to portions other than the packing control unit 62, the optical fiber 6 la and the photoelectric converter 61 of the packing system 132 shown in Fig. 9 through a LAN cable 91, and the weighing control unit and the packing control unit are collected as a weighing and packing control unit 93 which is connected to the LAN cable 91 through an optical fiber 94a and a photoelectric converter 94.

The weighing and packing system according to the present embodiment also has excellent quick response to control information and flexibility with addition and change of hardware. In addition, single management of the weighing and packing system can be performed.

Furthermore, the weighing and packing system according to the present invention can have a structure in which a serial signal line 156, a first serial interface 155 and a second serial interface 154 are provided in place of the parallel signal line 86, the first parallel interface 85 and the second parallel interface 84 in Fig. 1 as shown in Fig. 11. With this structure, all the above-mentioned signals are usually sent and received through the weighing control unit 26, the optical fiber 32a, the photoelectric converter 32 and the serial line 32b. If abnormalities such as disconnection are caused, all signals are sent and received through the serial signal line 156, the first serial interface 155 and the second serial interface 154. Also in the case where the interlock signal is transmitted with delay through the optical fiber 32a and the like for some reasons, it can be sent and received through the serial signal line 156. Thus, a transmission line of the signal is caused to have redundancy so that it is not necessary to stop weighing and packing operation even if abnormalities are caused on the optical fiber 32a and the like which are usually used.

The weighing and packing system according to the present invention can also have a structure in which a serial signal line 166, a first serial interface 165 and a second serial interface 164 are provided in place of the parallel signal line 126, the first parallel interface 125 and the second parallel interface 124 in Fig. 8 as shown in Fig. 12. Also in this structure, all the above-mentioned signals are always sent and received through the packing control unit 62, the optical fiber 66a, the photoelectric converter 66 and the serial line 66b. In the same manner as in Fig. 11, a transmission line of the signal has redundancy. Therefore, also in the case where abnormalities are caused on the optical fiber 66a and the like which are usually used, it is not necessary to stop the weighing and packing operation.

The weighing and packing system of the present invention has a structure in which the weighing driving section for causing the weighing unit to perform weighing operation and the weighing control section for controlling the weighing driving section are mutually connected to the weighing system through the LAN. Therefore, excellent quick response to control information can be obtained and hardware such as the weighing unit can be added and changed rapidly.

Since the weighing and packing system according to the present invention has a structure in which the packing driving section for causing the packer to perform packing operation and the packing control section for controlling the packing driving section are mutually connected to the packing system through the LAN. Therefore, excellent quick response to control information and the like can be obtained and the hardware can be added and changed rapidly.

Furthermore, since the weighing and packing system according to the present invention has a structure in which the weighing system and the packing system are connected to each other through the parallel signal line, it has excellent quick response to the interlock signal.

The weighing and packing system according to the present invention has a structure in which the weighing system and the packing system are connected to each other through the serial signal line. Therefore, the transmission line of the signal can have redundancy. Also in the case where abnormalities are caused on the optical fiber and the like which are usually used, they can be eliminated while continuously performing the weighing and packing operation.

Although the present invention has fully been described by way of example with reference to the accompanying drawings, it is to be understood that various changes and modifications will be apparent to those skilled in the art. Therefore, unless otherwise such changes and modifications depart from the scope of the invention, they should be construed as being included therein.

Claims

1. A weighing and packing system comprising:

   a weighing system including a plurality of weighing units forming a combination scale, a weighing driving section provided on each of the weighing units for causing the weighing unit to perform weighing operation, a weighing control unit having a weighing control section for controlling the weighing driving section, and an operation indicating section for setting operating conditions of the weighing system and for displaying an operation state, a LAN for mutually connecting the weighing driving section and the weighing control unit, and a first parallel interface connected to the LAN;

   a packing system including a packer for pack-

ing an article to be weighed which has a packing driving section for causing packing operation to be performed, a packing control section for controlling the packing driving section, and a second parallel interface;
a parallel signal line for connecting the first parallel interface to the second parallel interface; and
signal transmitting means for connecting the operation indicating section of the weighing system to the packing control section,
wherein the operation indicating section sets operating conditions of the weighing system and displays an operation state, and sets operating conditions of the packing system and displays an operation state through the signal transmitting means, and the parallel signal line sends and receives an interlock signal between the weighing driving section and the packing driving section.

2. A weighing and packing system comprising:

a weighing system including a plurality of weighing units, each of which forms a combination scale and has a weighing driving section for causing weighing operation to be performed, a weighing control section for controlling the weighing driving section, and a first parallel interface;
a packing system including a packer for packing an article to be weighed, a packing driving section for causing the packer to perform packing operation, a packing control unit having a packing control section for controlling the packing driving section and an operation indicating section for setting operating conditions of the packing system and for displaying an operation state, a LAN for mutually connecting the packing driving section and the packing control unit, and a second parallel interface connected to the LAN;
a parallel signal line for connecting the first parallel interface to the second parallel interface; and
signal transmitting means for serially connecting the operation indicating section of the packing system to the weighing control section,
wherein the operation indicating section sets operating conditions of the packing system and displays an operation state, and sets operating conditions of the weighing system and displays an operation state through the signal transmitting means, and the parallel signal line sends and receives an interlock signal between the weighing driving section and the packing driving section.

3. A weighing and packing system comprising:

a weighing system including a plurality of weighing units forming a combination scale, a weighing driving section provided on each of the weighing units for causing the weighing unit to perform weighing operation, a weighing control unit including a weighing control section for controlling the weighing driving section, and an operation indicating section for setting operating conditions of the weighing system and for displaying an operation state, and a LAN for mutually connecting the weighing driving section and the weighing control unit; and
a packing system including a packer for packing an article to be weighed, a packing driving section for causing the packer to perform packing operation, a packing control unit having a packing control section for controlling the packing driving section and an operation indicating section for setting operating conditions of the packing system and for displaying an operation state, and a LAN for mutually connecting the packing driving section and the packing control unit,
wherein the LAN of the weighing system and the LAN of the packing system are further connected to each other to form a single LAN.

4. A weighing and packing system comprising;

a packer for packing an article to be weighed and a plurality of weighing units forming a combination scale; and
a weighing system including a weighing driving section provided on the weighing unit for causing the weighing unit to perform weighing operation, a packing driving section for causing the packer to perform packing operation, and a weighing and packing control unit having a weighing control section for controlling the weighing driving section, a packing control section for controlling the packing driving section and an operation indicating section for setting operating conditions of the weighing and packing system and for displaying an operation state,
wherein the weighing driving section, the packing driving section and the weighing and packing control unit are mutually connected through the LAN.

5. A weighing and packing system comprising:

a weighing system including a plurality of weighing units forming a combination scale, a weighing driving section provided on each of the weighing units for causing the weighing unit

to perform weighing operation, a weighing control unit having a weighing control section for controlling the weighing driving section and an operation indicating section for setting operating conditions of the weighing system and for displaying an operation state, a LAN for mutually connecting the weighing driving section and the weighing control unit, and a first serial interface connected to the LAN;
a packing system including a packer for packing an article to be weighed which has a packing driving section for causing packing operation to be performed, a packing control section for controlling the packing driving section, and a second serial interface;
a serial signal line for connecting the first serial interface to the second serial interface; and
signal transmitting means for connecting the weighing control unit of the weighing system to the packing control section,
wherein the operation indicating section sets operating conditions of the weighing system and displays an operation state, and the first and second serial interfaces and the serial signal line send and receive information through the LAN of the weighing system or the signal transmitting means if abnormalities are caused on the LAN or the signal transmitting means.

6. A weighing and packing system comprising:

a weighing system including a plurality of weighing units, each of which forms a combination scale and has a weighing driving section for causing weighing operation to be performed, a weighing control section for controlling the weighing driving section, and a first serial interface;
a.packing system including a packer for packing an article to be weighed, a packing driving section for causing the packer to perform packing operation, a packing control unit having a packing control section for controlling the packing driving section and an operation indicating section for setting operating conditions of the packing system and for displaying an operation state, a LAN for mutually connecting the packing driving section and the packing control unit, and a second serial interface connected to the LAN;
a serial signal line for connecting the first serial interface to the second serial interface; and
signal transmitting means for serially connecting the packing control unit of the packing system to the weighing control section,
wherein the operation indicating section sets operating conditions of the packing system and displays an operation state, and the first and second serial interfaces and the serial signal line send and receive information through the LAN of the packing system or the signal transmitting means if abnormalities are caused on the LAN or the signal transmitting means.

7. The weighing and packing system as defined in any of Claims 1 and 3 to 5, further comprising a center vibrator unit connected to the LAN of the weighing unit for feeding an article to be weighed to the weighing unit, the center vibrator unit including a center vibrator for feeding the article to the weighing unit by vibration, a feeder driver for driving the center vibrator, article detecting means for detecting a quantity of the article on the center vibrator, and digital converting means for converting an input from the article detecting means to a digital signal.

8. The weighing and packing system as defined in any of Claims 1 and 3 to 5, further comprising a collecting gate unit connected to the LAN of the weighing unit, the collecting gate unit including drivers for driving an assembled gate for storing the article discharged from the weighing unit and for discharging the same article in a predetermined timing, and gate switching means for controlling to open or close the collecting gate.

9. The weighing and packing system as defined in any of Claims 1 to 8, wherein the weighing unit includes one or more hopper switching means for performing weighing operation and one or more load cells, and the weighing driving section includes a driver of the hopper switching means and an A / D converter for A / D converting a weighed value of the load cell.

10. The weighing and packing system as defined in any of Claims 1 to 9, wherein the packer includes one or more seal pressing means for performing packing operation, one or more belts, one or more sensors and one or more heating means, and the packing driving section includes drivers of the seal pressing means and the belt, a controller of the sensor, and a temperature controller of the heating means.

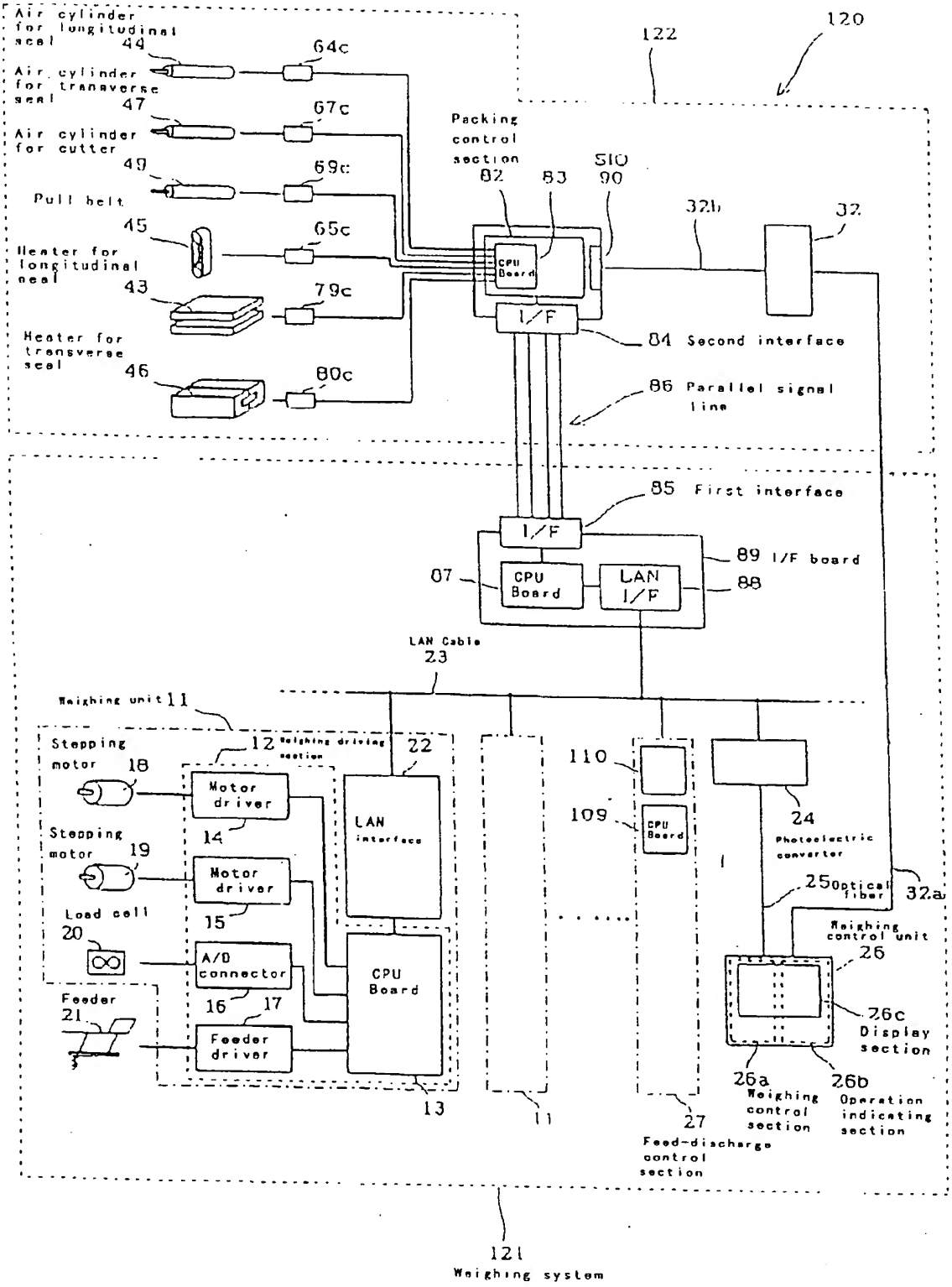
11. A weighing and packing system comprising a weighing system and a packing system wherein the weighing system is connected to the packing system by means of a parallel signal line.

12. A packing system wherein the components of the system are connected through a LAN.

13. A weighing and packing system wherein the components of the weighing system and of the packing system are connected through a LAN.

14. A weighing and packing system comprising a weighing system and a packing system wherein the weighing system is connected to the packing system by means of a first signal line and a second, independent, signal line.

Fig. 1



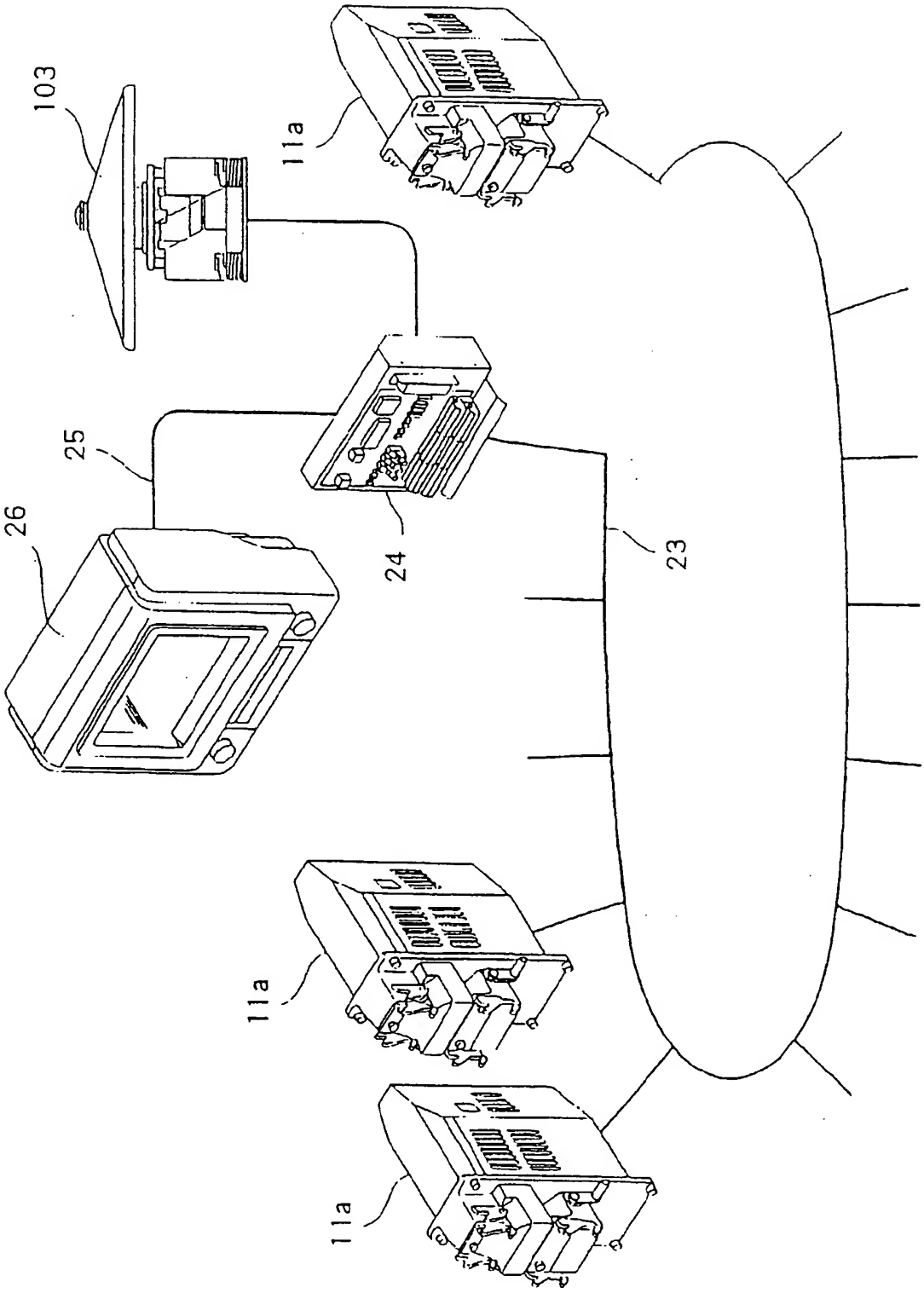


Fig. 2

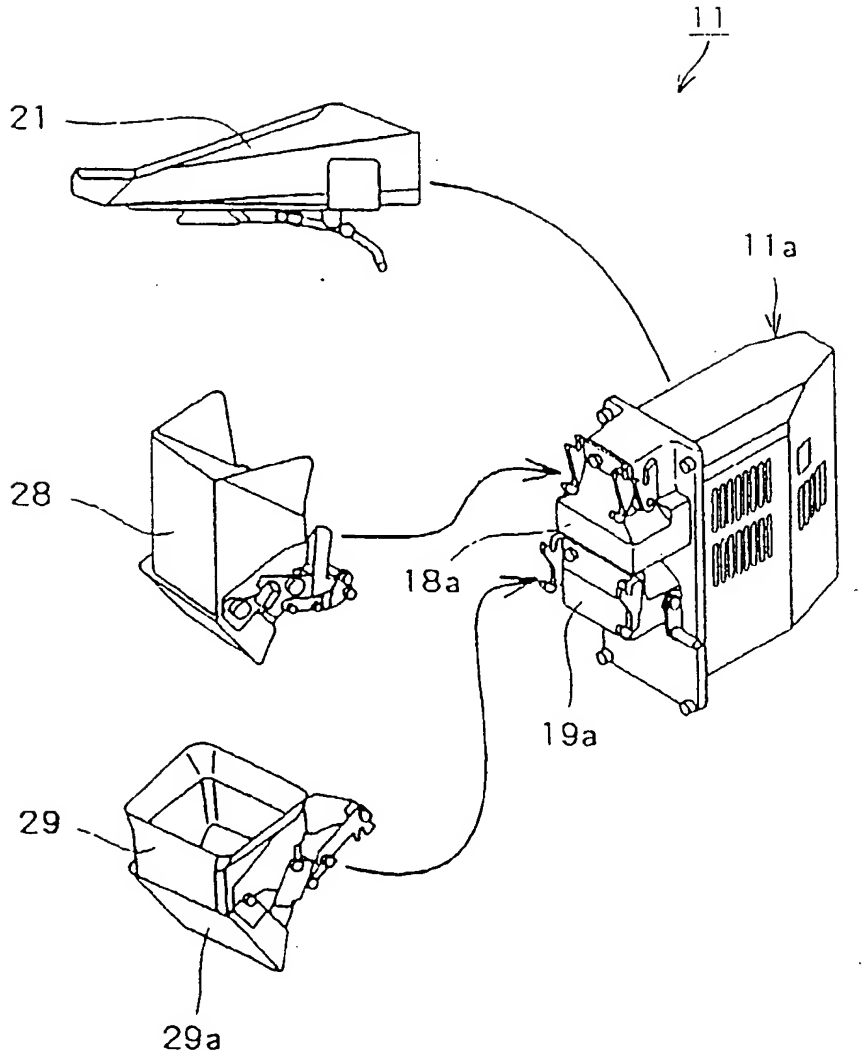


FIG. 8

Fig. 4

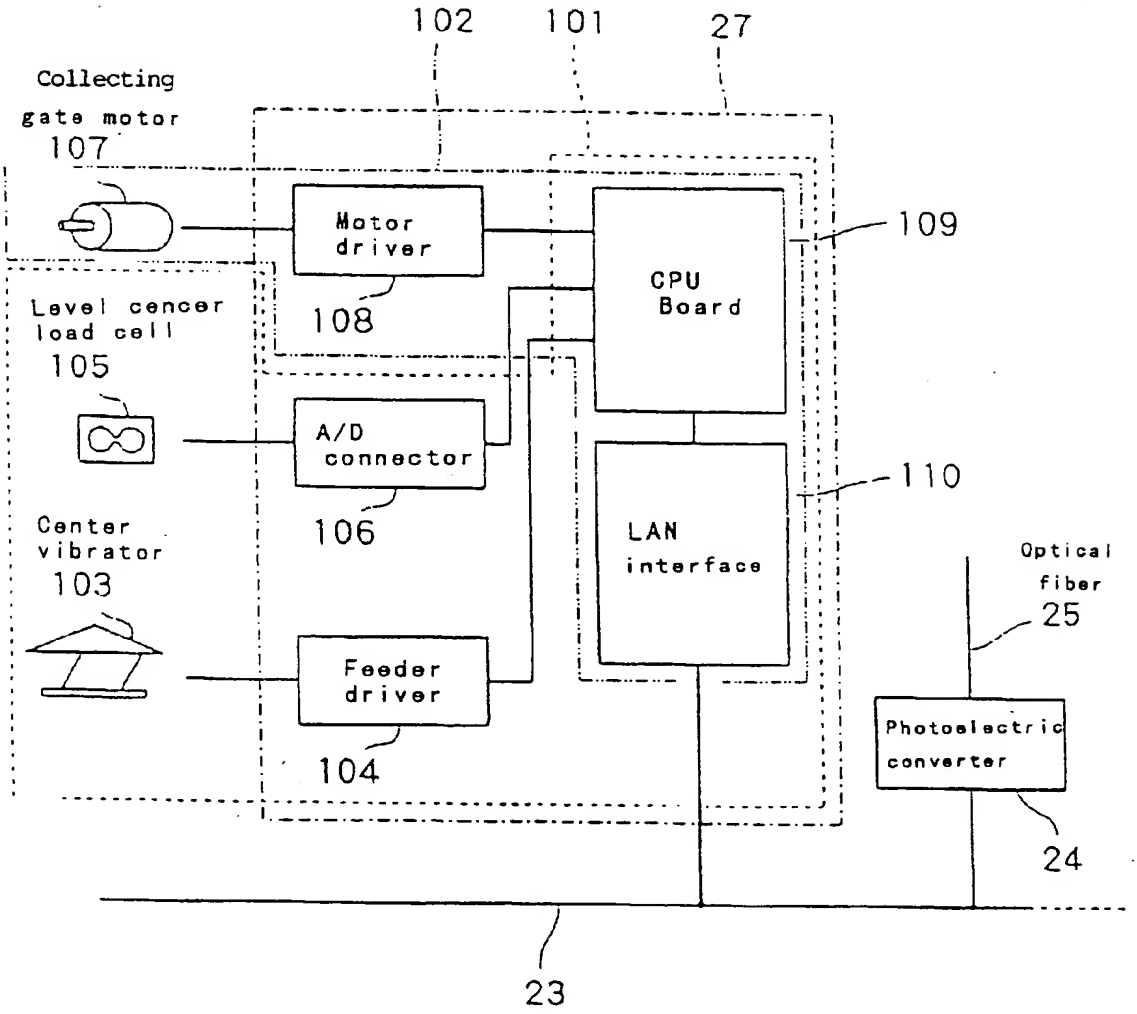


Fig. 5

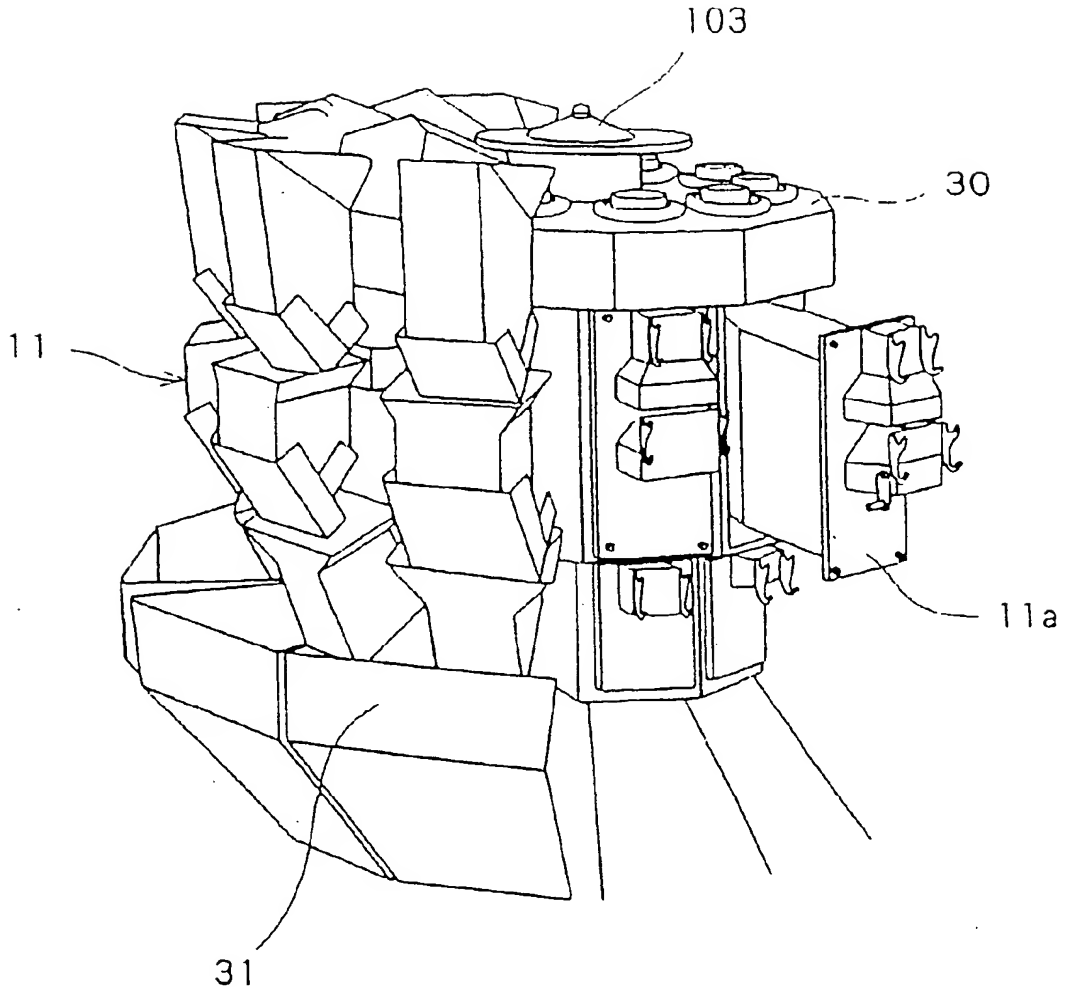
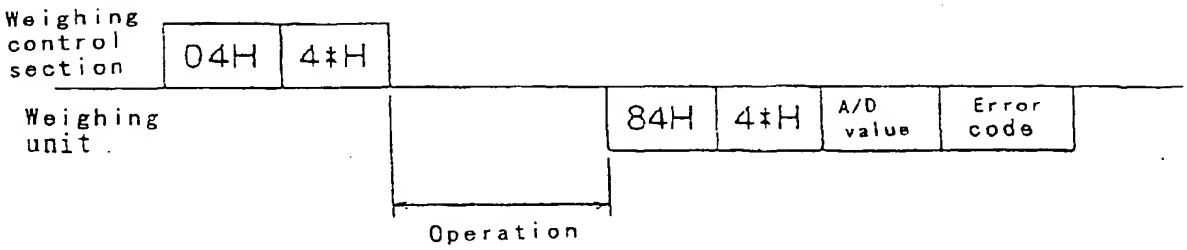


Fig. 6



Command: 4*H
40H = Start consecutive operation
41H = Start feeder 21
42H = Start feed hopper 28
43H = Start weighing hopper 29

Fig. 7

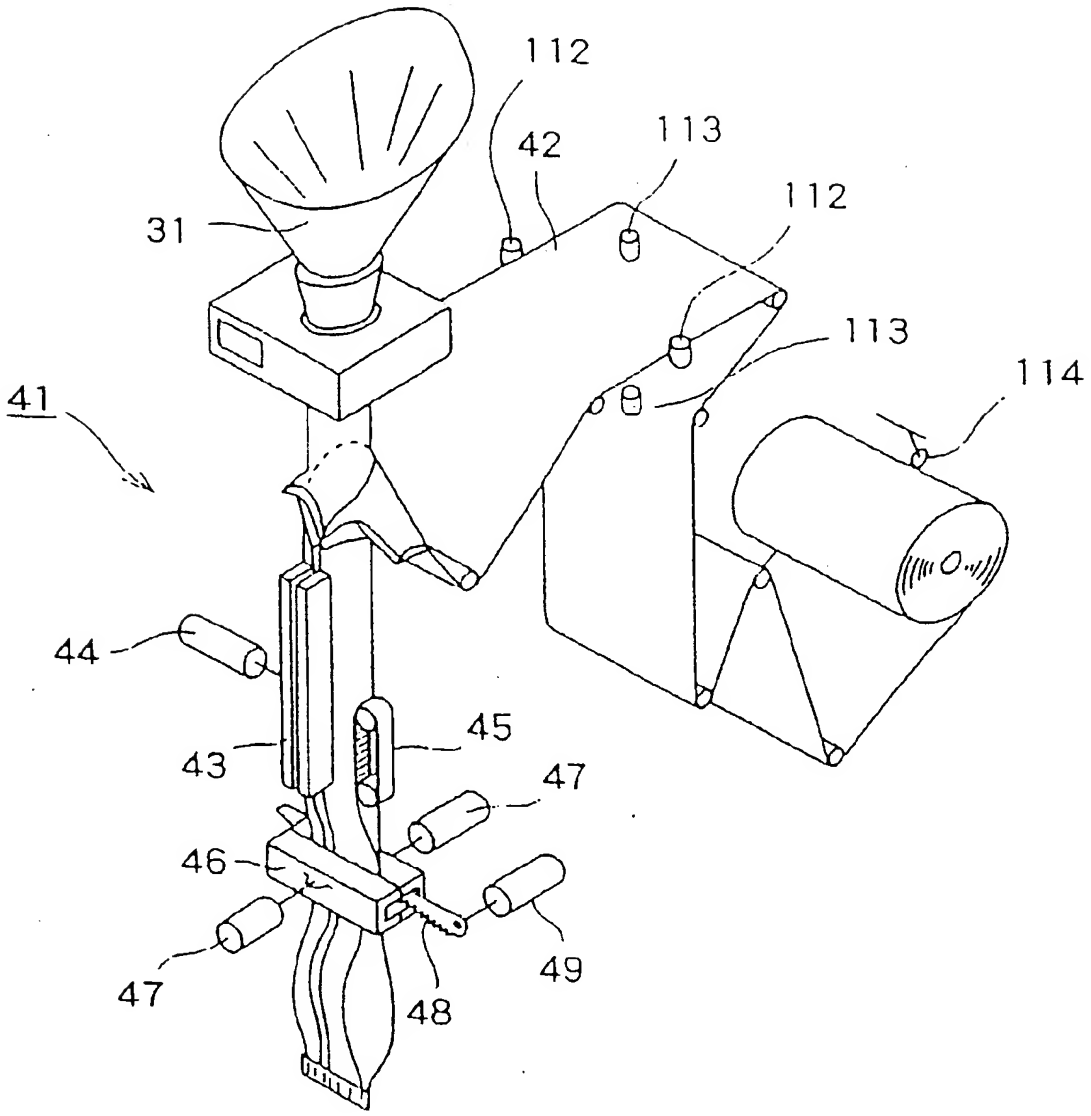


Fig. 8

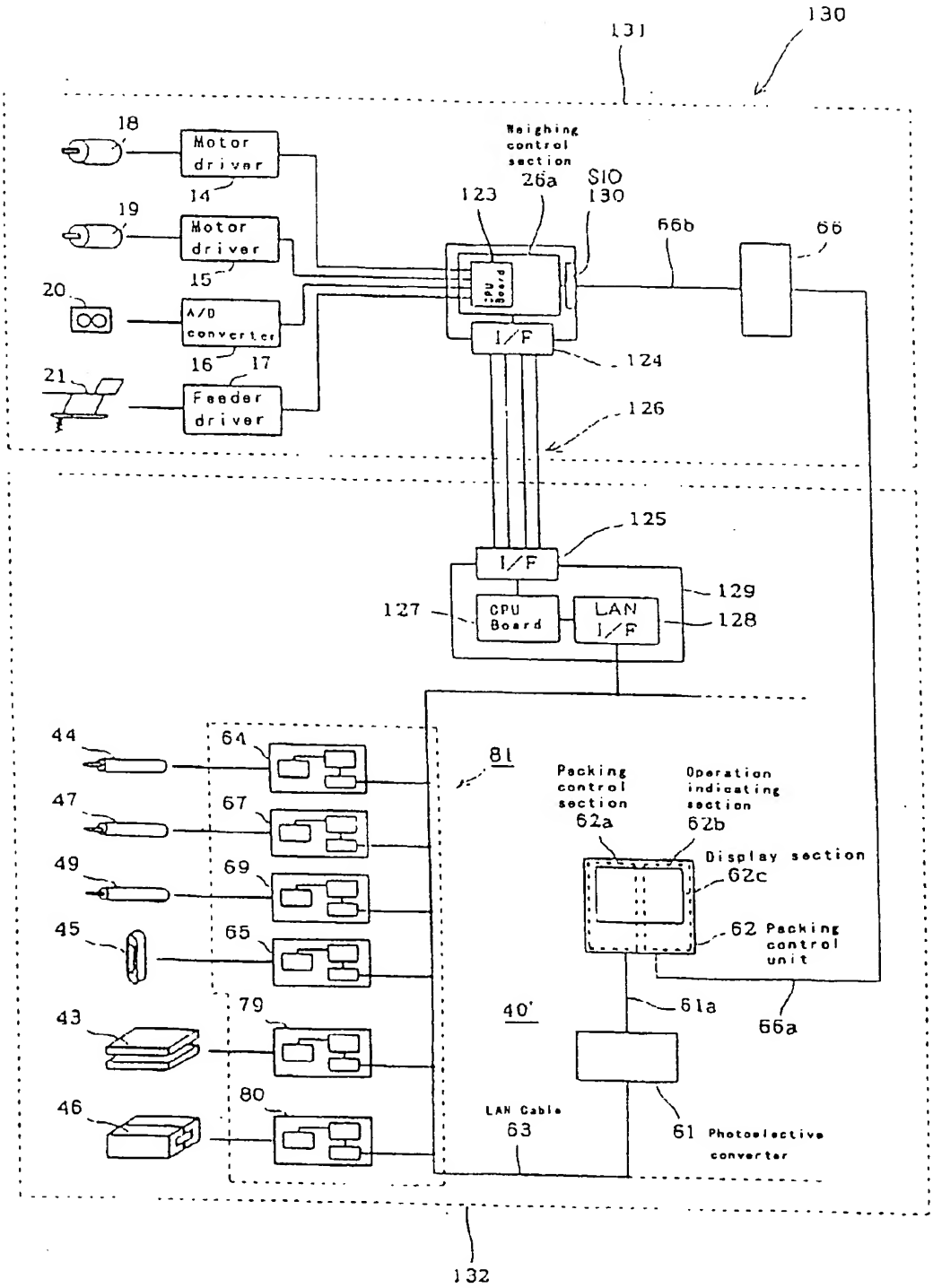


FIG. 10

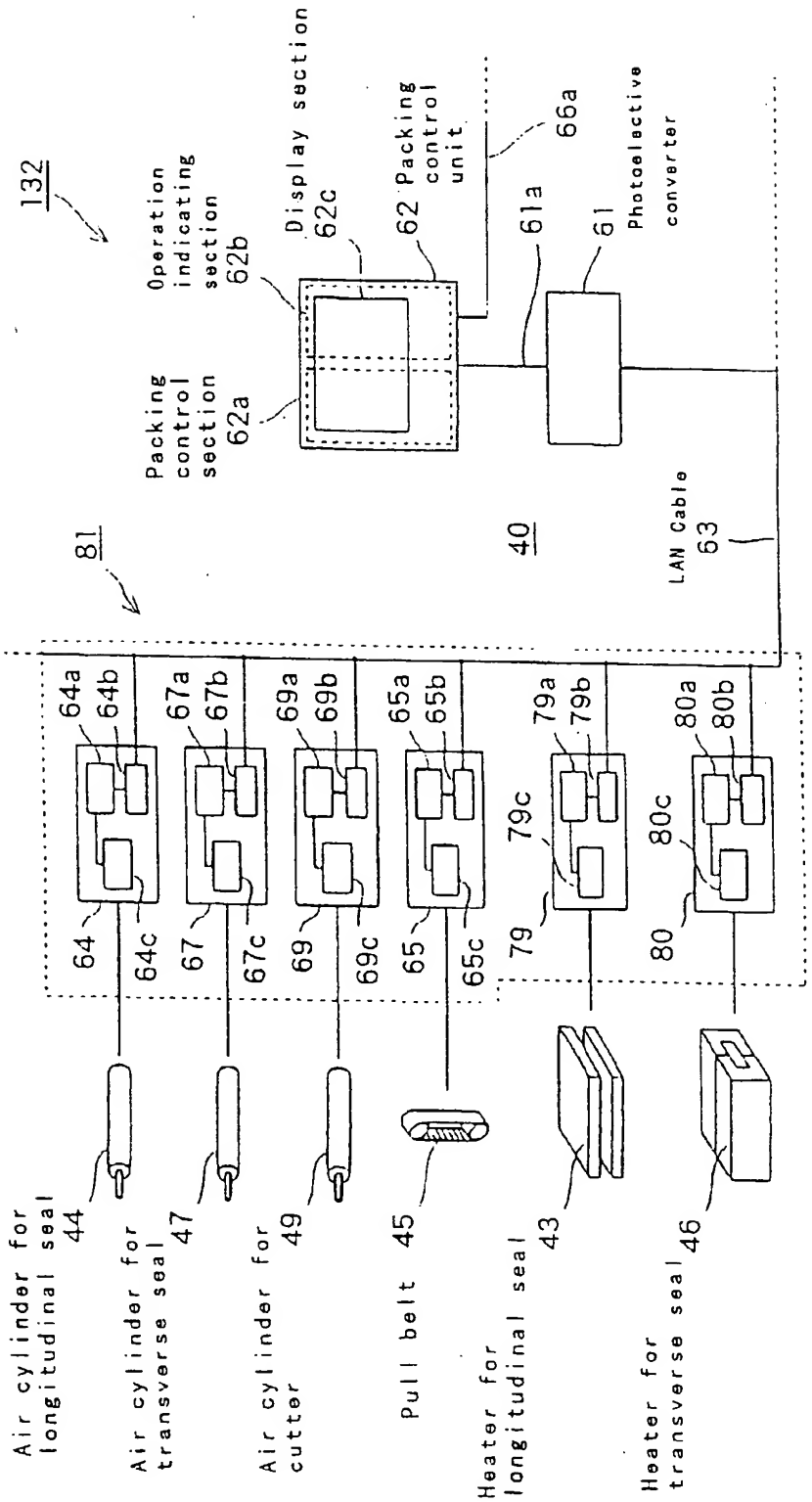


Fig. 10

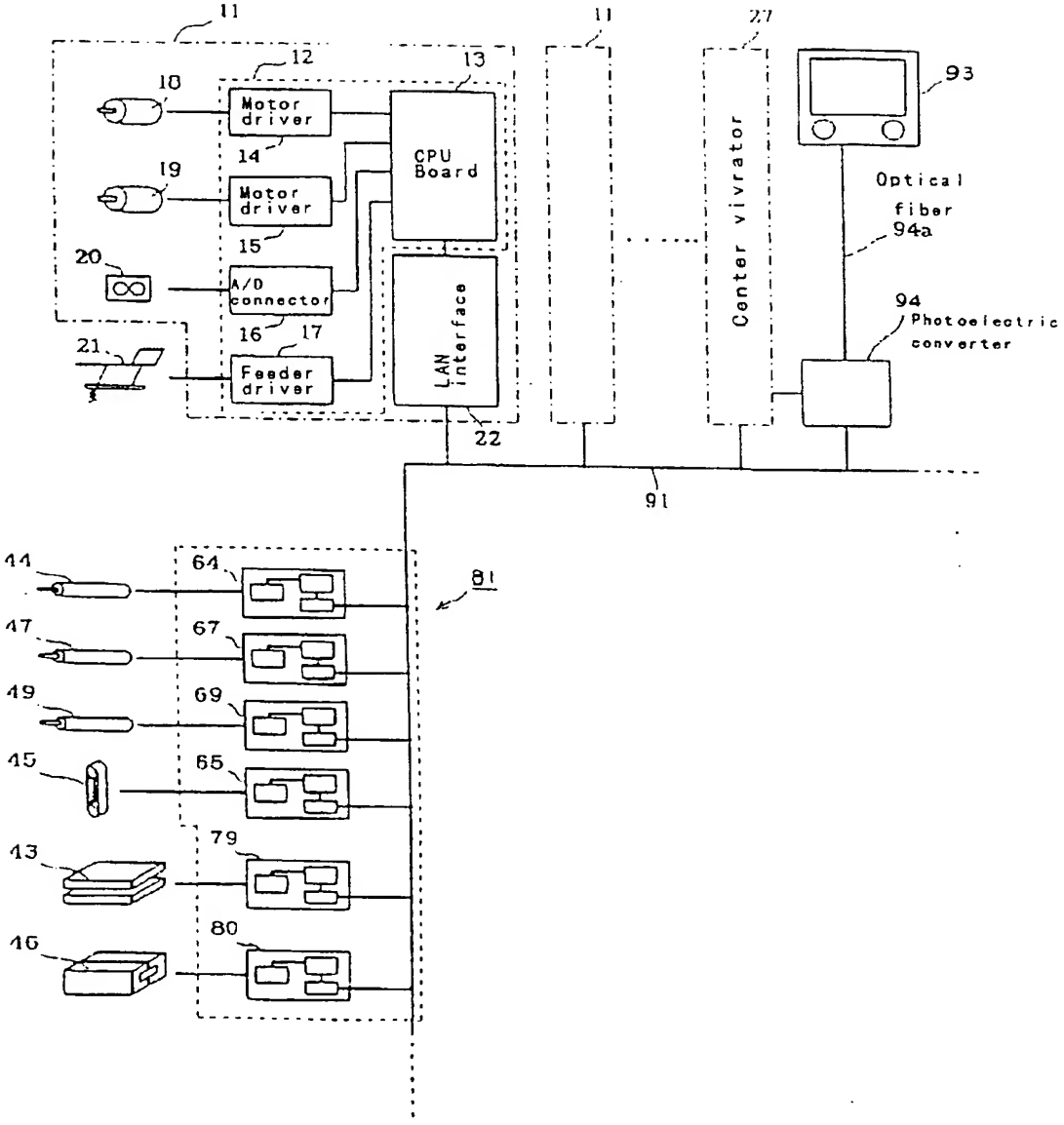
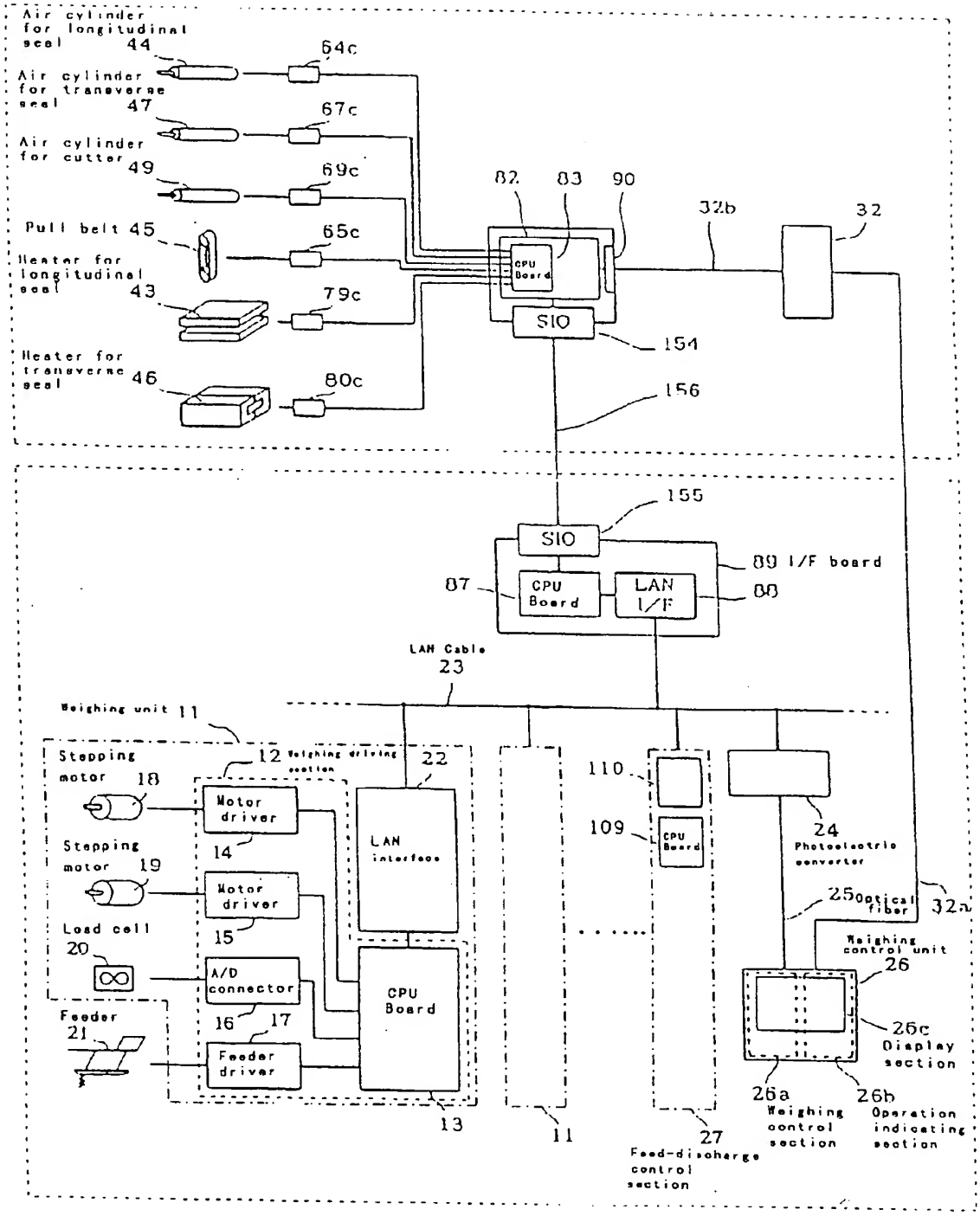


Fig. 11



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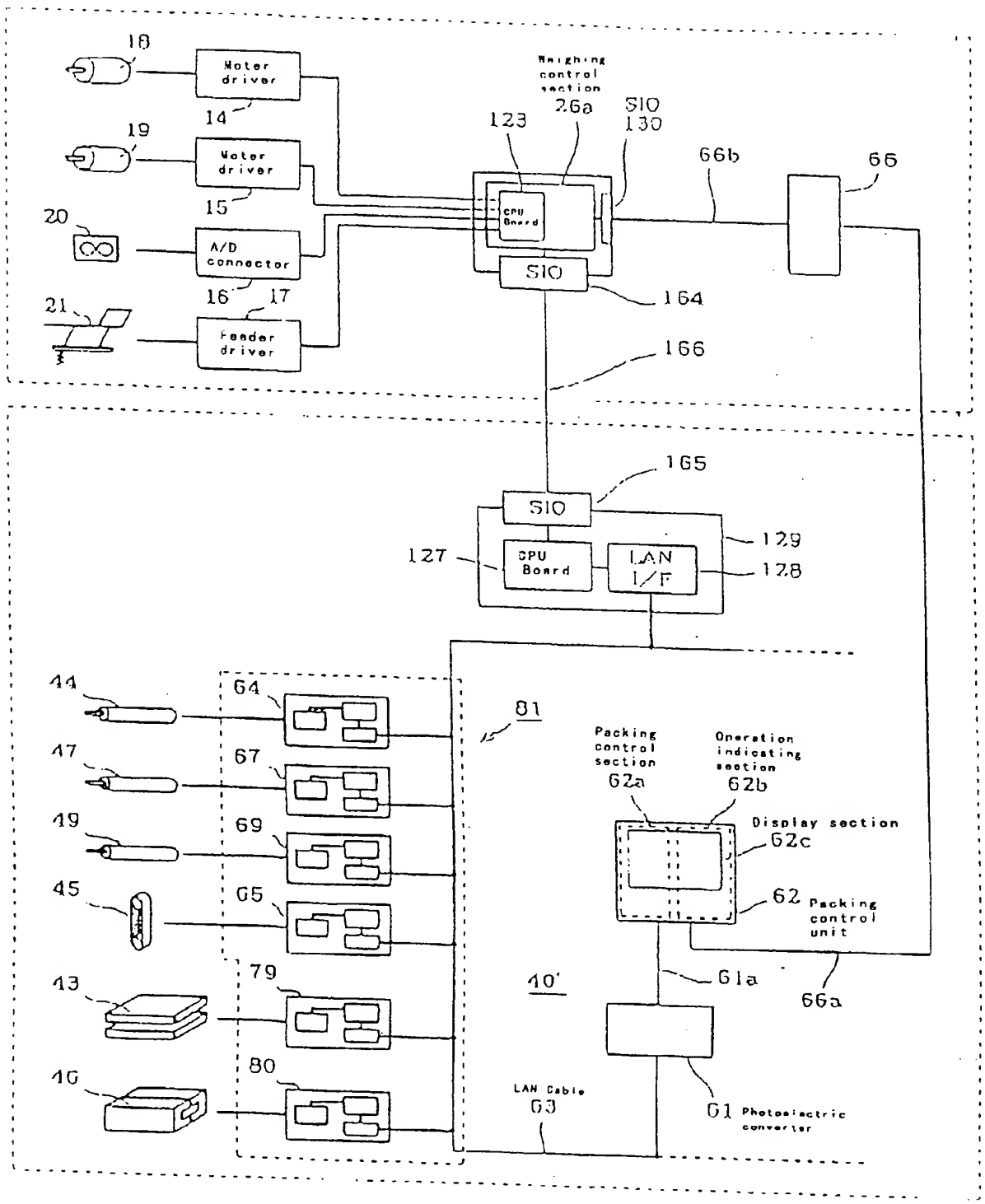
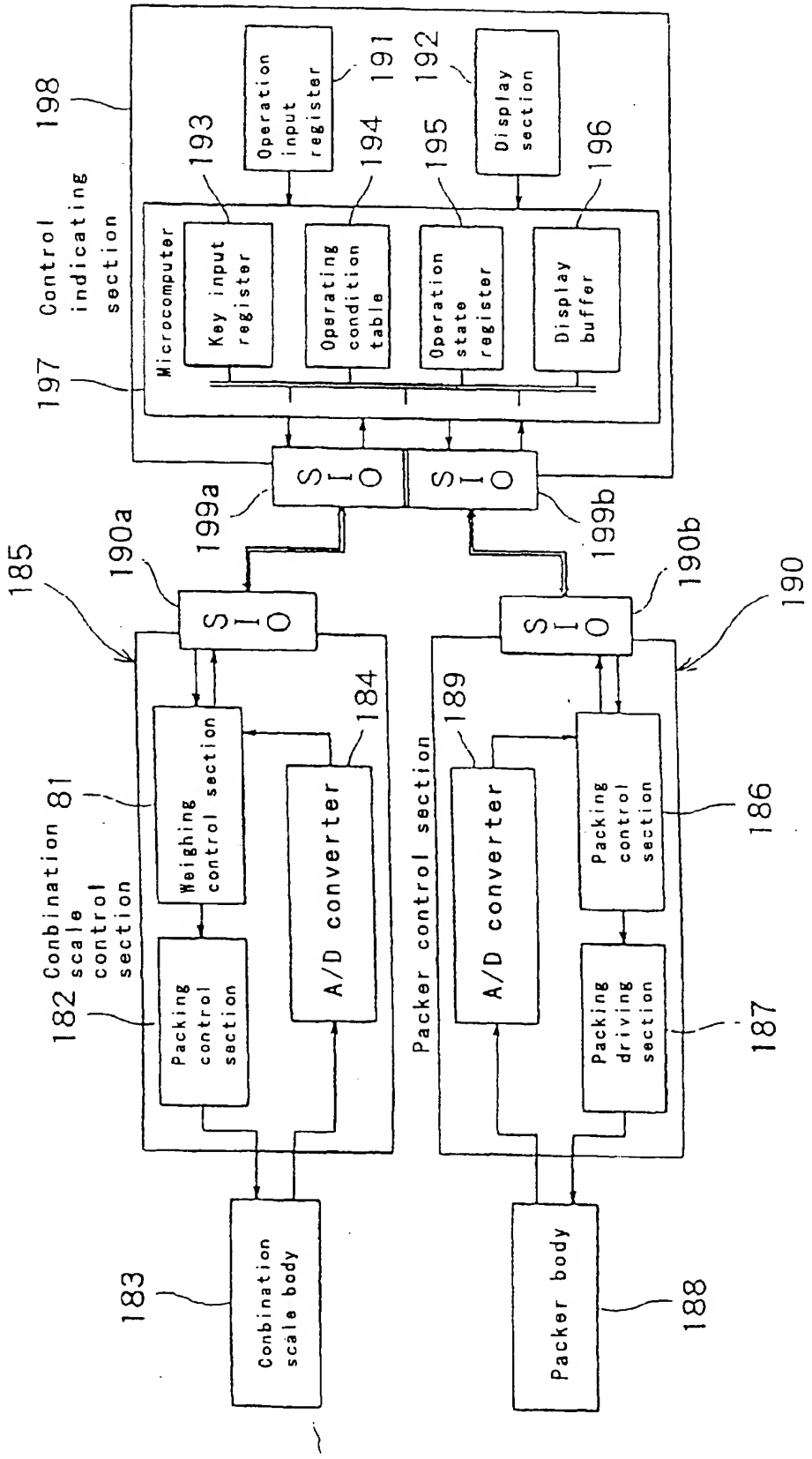


Fig. 13



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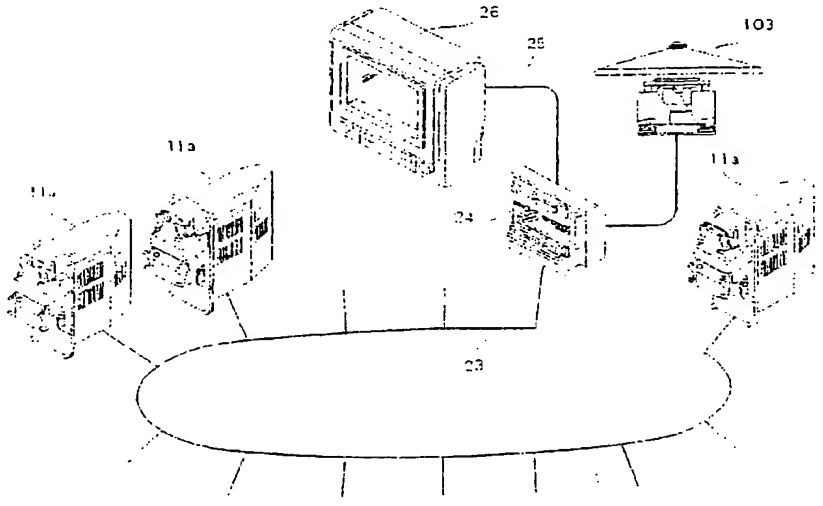
(54) Weighing and packing system

(57) Provided is a weighing and packing system having excellent quick response to control information and capable of easily adding and changing hardware. A weighing driving section 12 is provided on each weighing unit 11 forming a combination scale of a weighing system 121. The weighing driving section 12 is formed by a CPU board 13, motor drivers 14 and 15 for driving stepping motors 18 and 19, a load cell 20, an A / D converter 16, and a feeder driver 17 for driving a feeder 21. The CPU board 13 is connected to a LAN cable 23 through a LAN interface 22. An interface board 89 having a first interface 85 is connected to the LAN cable 23, which are connected to a second interface 84 provided on a packing control section 82 on a packing system 122 side through four parallel signal lines. In addition, a weighing control unit 26 for giving control information is provided on the weighing driving section 12 of the weighing unit 11. The weighing control unit 26 is connected to the LAN cable 23 and is connected to the packing control section 82 through a serial line 32b.

Fig. 2



EP 0 825 424 A3

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EUROPEAN SEARCH REPORT

Application Number
EP 97 30 6375

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
Y	US 4 813 205 A (MIKATA YOSHITAKA ET AL) 21 March 1989 * the whole document * ---	1-6,11, 13,14	G01G19/393
Y	KERL H.D.: "Ein Kommunikationssystem nicht nur für die Wägetechnik" MESSEN PRUFEN AUTOMATISIEREN. INTERNATIONALES FACHJOURNAL FUR MESS-, STEUER- UND REGELTECHNIK, no. 7-8, July 1985, pages 396-399, XP002081636 BAD WORISHOFEN DE * the whole document * ---	1-6,11, 13,14	
A	EP 0 319 202 A (TOLEDO SCALE CORP) 7 June 1989 * page 3, line 45 - line 48; figure 1 * ---	1-6,11, 13,14	
A	K. CLEVERMANN: "Entwicklungstendenzen in der automatisierten Wägetechnik" TECHNISCHES MESSEN TM. 1982 - 1988 INCOMPLETE., vol. 58, no. 5, May 1991, pages 184-187, XP002081637 MUNCHEN DE * the whole document * -----	1-6,11, 13,14	TECHNICAL FIELDS SEARCHED (Int.Cl.6) G01G

~~The present search report has been drawn up for all claims~~

Place of search	Date of completion of the search	Examiner
THE HAGUE	22 October 1998	GANCI P.A.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

European Patent Office

Application Number
EP 97 30 6375

CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing more than ten claims.

☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims and for those claims for which claims fees have been paid, namely claim(s):

☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

☐ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

☒ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:

1 - 11 , 13 , 14

☐ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:

European Patent Office

LACK OF UNITY OF INVENTION
SHEET B

Application Number
EP 97 30 6375

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. Claims: 1-11,13,14

   Weighing and packing system uses LAN cable to interconnect weighing drivers on weighing sections with weighing and packing control

2. Claim : 12

   Packing system where the components are connected through a LAN

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 97 30 6375

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

22-10-1998

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82